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POCKET GUIDE
to the
IMPROVED GRADING SYSTEM
for
PONDEROSA PINE and SUGAR PINE
Saw Logs in Trees

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Forest Service - U. S. Department of Agriculture

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**POCKET GUIDE
to the
IMPROVED GRADING SYSTEM
for
PONDEROSA PINE and SUGAR PINE
Saw Logs in Trees**

By
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with illustrations by
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Pacific Southwest Forest and
Range Experiment Station
Forest Service
U. S. Department of Agriculture
Berkeley, California
1964

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Foreword

This Pocket Guide has been prepared as an abbreviated supplement to two major publications:

65022
CST44
no. 75
Gaines, Edward M. Improved System for Grading Ponderosa Pine and Sugar Pine Saw Logs in Trees. U. S. Forest Serv. Pacific Southwest Forest & Range Expt. Sta. Tech. Paper 75, 21 pp., illus. 1962.

Jackson, Willard L. Guide to Grading Defects in Ponderosa and Sugar Pine Logs. U. S. Forest Serv. Pacific Southwest Forest & Range Expt. Sta. 34 pp., illus. 1962

Log graders working on ponderosa and sugar pine should be familiar with these publications. The Pocket Guide does not modify them in any way. It is intended only as a handy field reference.

General Specifications and Definitions

1. Apply grades to 16-foot logs as cruised. Disregard defects below standard stump height; include defects that are within standard trimming allowances.

2. Grade each log independently, without considering grade of other logs in the tree.

3. Do not grade cull logs. Otherwise, do not consider volumes of scaling defect when grading.

4. Grade on log-surface characteristics only. Grading defects (primary and secondary) determine the grade; false defects and indeterminate defects do not affect log grade.

5. Primary defects (log knots): All limbs, limb stubs, overgrown limbs, and other indications of places where limbs have grown.

6. Secondary defects:

- a. Scars of all types.
- b. Burls, unsound, or large (wider than one-fourth log circumference).
- c. Forks and crooks--area of distorted stem surface.
- d. Cankers of all types.
- e. Cracks due to natural causes.

7. Log knots on scars or cankers are primary defects only if (a) larger than 2 inches in diameter, or (b) knot end is less than 5 inches from normal wood surface.

8. False defects: (little or no relation to wood quality).

- a. Small sound burls.
- b. Bumps (if not indicators of knots or scars).
- c. Flutes and flanges.
- d. Sapsucker work.
- e. Minor bark distortions (if not indicators of knots or scars).

9. Indeterminate defects: (relations to wood quality poorly defined).

- a. Spiral grain.
- b. Sweep.

10. Panel: Basic unit of log surface. Used to define extent of defect grouping or extent of defect-free areas.

- a. One-quarter log circumference by 4 feet long.
- b. Sides follow log taper; ends square with log axis.
- c. Locate panels individually; scatter or stagger over log surface.

- d. Panels of one type (defect-free or defect-containing) must not overlap.
- e. When enclosing defects (log grades 1 and 2), entire area of every grading defect must be within panels.
- f. When excluding defects (log grade 3), all panels must be entirely free of grading defect.

11. Primary defects always take precedence over secondary defects.

12. Follow the definitions exactly and consistently.

Log Grade Specifications and Examples

Specifications for the Improved Grades are briefly summarized as follows:

Grade	Defects Permitted	
	Primary(log knots)	Secondary(scars, etc.)
1	One log knot not over one-half inch diameter	Confined to 3 panels or less
2	Confined to 4 panels or less	Secondary plus primary confined to 6 panels or less
3	Six panels free of all grading defects	
4	(a) 80 percent bark limbs (b) Bark limbs not exceed one-sixth log diameter; other log knots not exceed one-twelfth log diameter (c) Not more than 24 near maximum size	Confined to 3 panels or less
5	All other logs, if net scale one-third or more of gross	

Complete specifications appear with illustrations on the following pages; specifications for the applicable grade appear opposite each illustration.

An explanation and description of the salient features of each illustration follows the log grade specifications. Some illustrations demonstrate limits of grades, some show common log types that may be encountered, and some show helpful aids to grading. Some show log types that are rarely found, but are included to emphasize salient features of the Improved Grades.

"Most likely occurrence" is suggested for each illustrated log, but only as a general guide. Keep alert to catch unusual occurrences. When occurrence in old growth and young growth is mentioned, this again is only a general guide. Young growth ("blackjacks" or "blackbark" ponderosa pine trees) includes trees less than 150 years old. Younger old growth ("intermediates" or "redbark" ponderosa trees) up to 200 years or more may have many of the grading attributes of young growth.

The following legend is used to identify panels:

P + number: enclose primary defects.

S + number: enclose secondary defects.

Number only: free of all defects.

Primary defects (log knots) are indicated with symbols on the drawings, as follows:

- --bark limbs (live or recently dead).
- --other limbs (without bark) and limb stubs.
- ✕ --overgrown knots.

Figure 1 - Grade 1 Log

Specifications:

Primary defects are limited to one and it (a "pin knot") may not exceed one-half inch in diameter. This single defect may be located anywhere on the log surface.

Secondary defects are admitted in addition to the pin knot, provided they can be confined within three panels or less.

Explanation:

A minimum grade 1 log. It has the one pin knot and also a fire scar (secondary defect) that can be contained within three panels by staggering the panel in the second row.

A second "pin knot" would degrade the log to grade 2, even if one or both of the "pin knots" were in the trim.

Most Likely Occurrence:

Butt log of old-growth trees.

Without scar--butt logs and second and occasionally third logs in tall clean-boled old-growth trees.

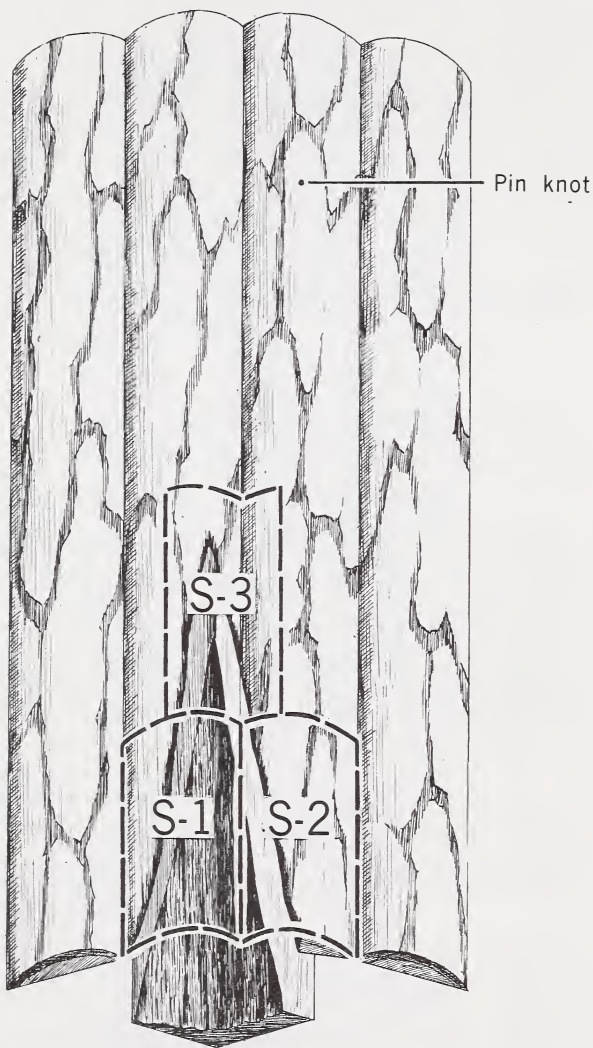


Figure 1

Figure 2 - Grade 1 Log

Specifications:

Primary defects are limited to one and it (a "pin knot") may not exceed one-half inch in diameter. This single defect may be located anywhere on the log surface.

Secondary defects are admitted in addition to the pin knot, provided they can be confined within three panels or less.

Explanation:

The small sound burls are false defects and are disregarded, regardless of the number or their location over the log. Single burls are more common than groups. Rarely, small burls may be so numerous as to give the log a "rough" appearance; they are still false defects.

The basal scar can easily be confined to a single panel and hence is permitted on a grade 1 log.

Most Likely Occurrence:

Butt logs of old-growth trees; second logs in tall old-growth trees.

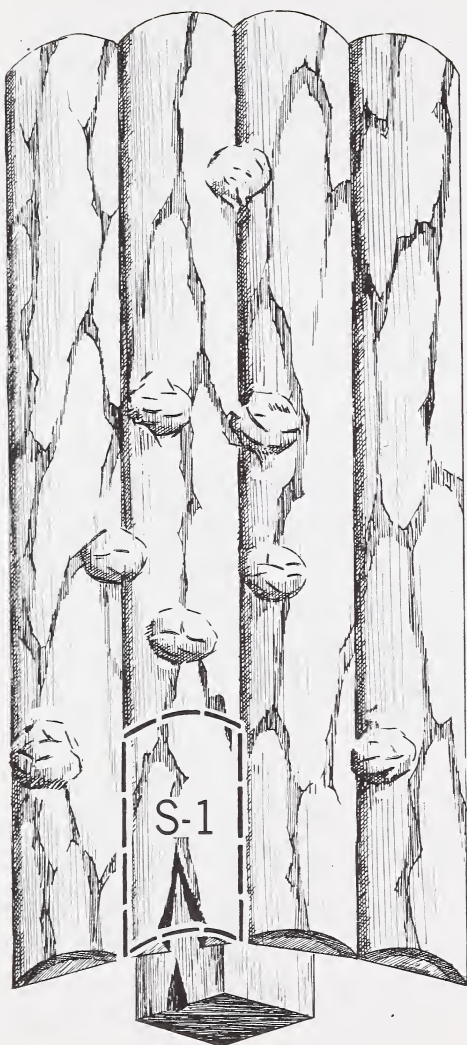


Figure 2

Figure 3 - Grade 2 Log

Specifications:

Primary defects are admitted without limit as to number or size, provided they can be confined within four panels or less.

Secondary defects are admitted, in addition to primary defects, provided that all grading defects can be confined within six panels or less.

Explanation:

A minimum grade 2 log with respect to primary defects: The four panels must be individually and carefully located to confine the 11 log knots. The log could also have secondary defect if confinable within two additional panels.

Place isolated log knots in the corners of panels to insure that each panel includes as many log knots as possible.

Watch especially for overgrown knots. They count the same as any other log knot.

Most Likely Occurrence:

Lower logs of old-growth trees.

Occasionally, butt logs of young-growth trees in fairly dense stands.

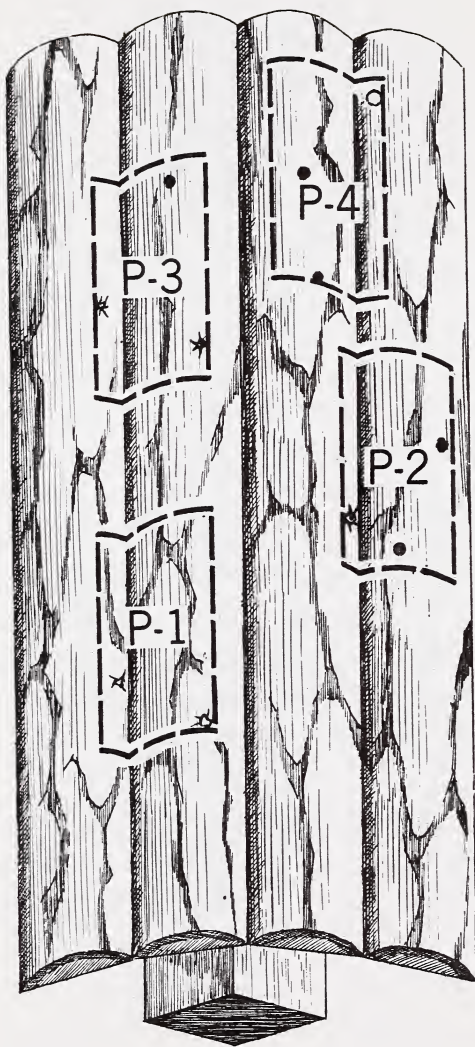


Figure 3

Figure 4 - Grade 2 Log

Specifications:

Primary defects are admitted without limit as to number or size, provided they can be confined within four panels or less.

Secondary defects are admitted, in addition to primary defects, provided that all grading defects can be confined within six panels or less.

Explanation:

A minimum grade 2 log with respect to secondary defects only (six panels required to contain defect).

Locate panels in each row with an edge of the scar in a corner of a panel, to insure that the fewest possible panels are required.

In tall trees, the log above this one may be grade 1; there are no knots on this log, and the second log could also be free of them.

Note: If the butt is "hollowed out" or seems quite rotten, examine the log very carefully, to be sure it is not a cull.

Most Likely Occurrence:

Butt log of old-growth trees.

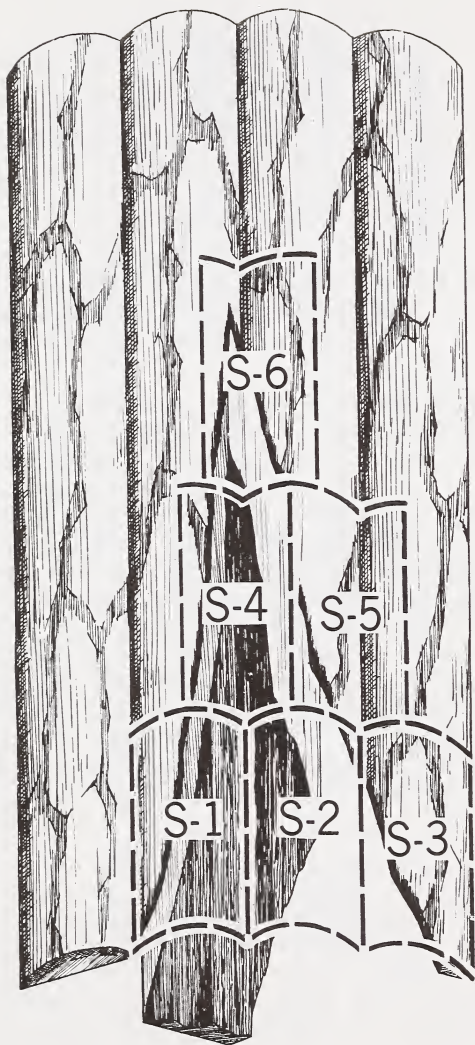


Figure 4

Figure 5 - Grade 2 Log

Specifications:

Primary defects are admitted without limit as to number or size, provided they can be confined within four panels or less.

Secondary defects are admitted, in addition to primary defects, provided that all grading defects can be confined within six panels or less.

Explanation:

A minimum grade 2 log containing both primary and secondary defects: six panels are required to contain all defects, two for the primary plus four for the secondary. The scar by itself would put the log in Grade 2, as would either of the log knots on panel P-1.

The "pin" knot in panel P-2 must be counted the same as any other log knot. A "pin" knot is disregarded only if: (a) it is the only primary defect on a Grade 1 log, or (b) it occurs on a scar or canker 5 inches or more below the normal wood surface.

Season checks, worm holes, rot, and massed pitch showing on the scar all count as part of the scar and do not further affect the grade.

Most Likely Occurrence:

Lower logs of old-growth trees.

Occasionally, butt logs of young-growth trees in dense stands.



Figure 5

Figure 6 - Grade 2 Log

Specifications:

Primary defects are admitted without limit as to number or size, provided they can be confined within four panels or less.

Secondary defects are admitted, in addition to primary defects, provided that all grading defects can be confined within six panels or less.

Explanation:

A common type of grade 2 log has all its log knots on one log face--four vertically aligned panels.

Note that four log knots can always be confined to four panels, and often to fewer. Also note that the top log knot must be included in a panel, even though it is in the trim.

The scar is easily confined to two panels and hence does not affect the grade.

Most Likely Occurrence:

Lower logs on trees in the edge of dense groups, or on the edge of openings.

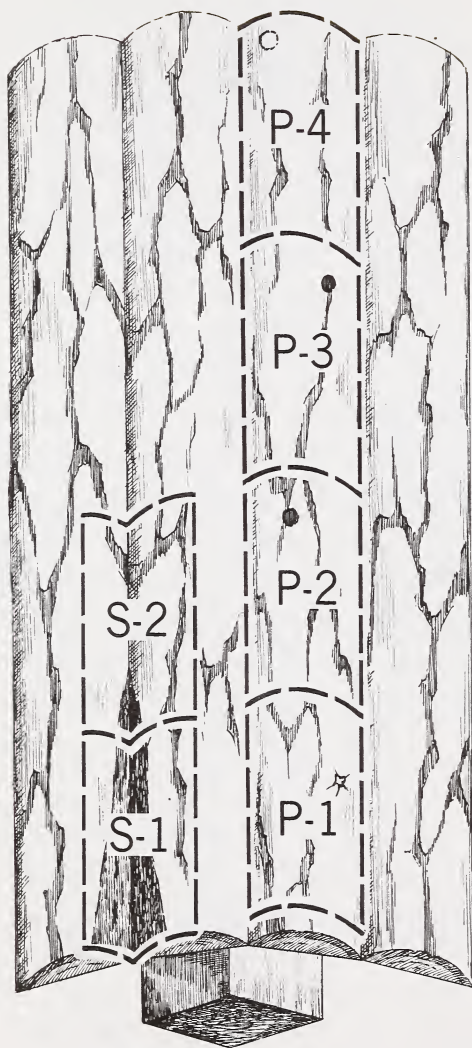


Figure 6

Figure 7 - Grade 2 Log

Specifications:

Primary defects are admitted without limit as to number or size, provided they can be confined within four panels or less.

Secondary defects are admitted, in addition to primary defects, provided that all grading defects can be confined within six panels or less.

Explanation:

As shown, a minimum grade 2 log. The burl exceeds one-fourth the log circumference and is by definition "large," and a secondary defect. It is easily confined to two panels and hence does not affect the grade.

A common type of grade 2 log has all its log knots confined to the top 4 feet. Obviously, they can all be included in four panels.

Most Likely Occurrence:

Lower logs of old-growth trees.

Without the burl--occasionally butt log of young-growth trees. (Large burls are very rare on young trees).

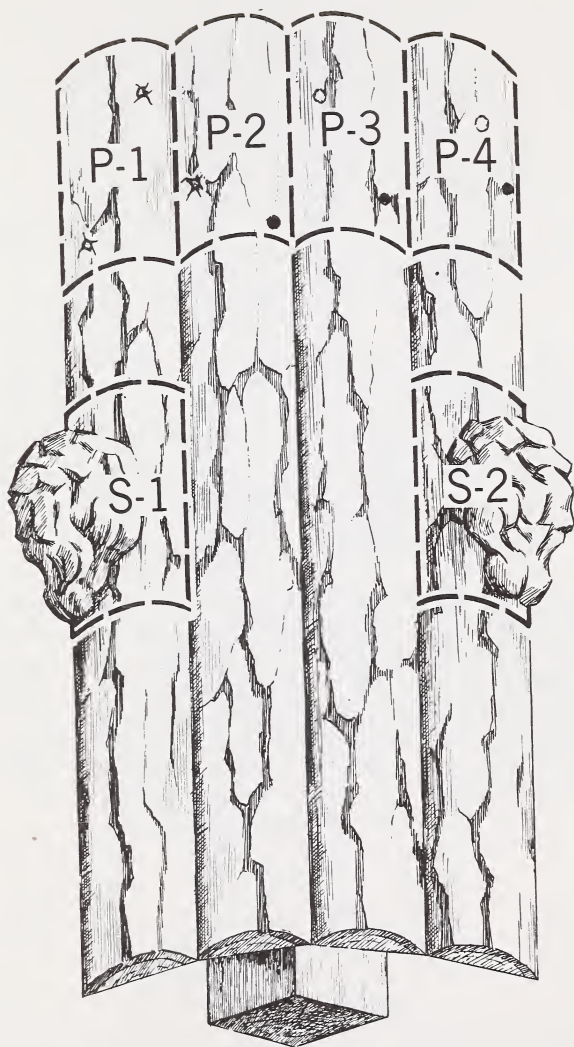


Figure 7

Figure 8 - Grade 2 Log

Specifications:

Primary defects are admitted without limit as to number or size, provided they can be confined within four panels or less.

Secondary defects are admitted, in addition to primary defects, provided that all grading defects can be confined within six panels or less.

Explanation:

A minimum grade 2 log.

There is a log knot on each of panels P-2 and P-3, and the panels are located to include also a 4-foot segment of the lightning scar. Count these panels as containing primary defects, for a total of four containing primary defects. One additional log knot, if so located that it could not be kept within a "P" panel even by shifting the boundaries, would drop the log to grade 3.

A narrow scar running the full length of a log will obviously require four panels to enclose 16 feet of scar length. The few inches of scar remaining in the trimming allowance should be disregarded. This is the only exception to the rule that all defect (in log grades 1 and 2) must be confined within panels, and it will rarely affect the grade of a log.

Most Likely Occurrence:

Lower logs of old-growth trees.

Occasionally, butt log of young-growth trees in dense stands.

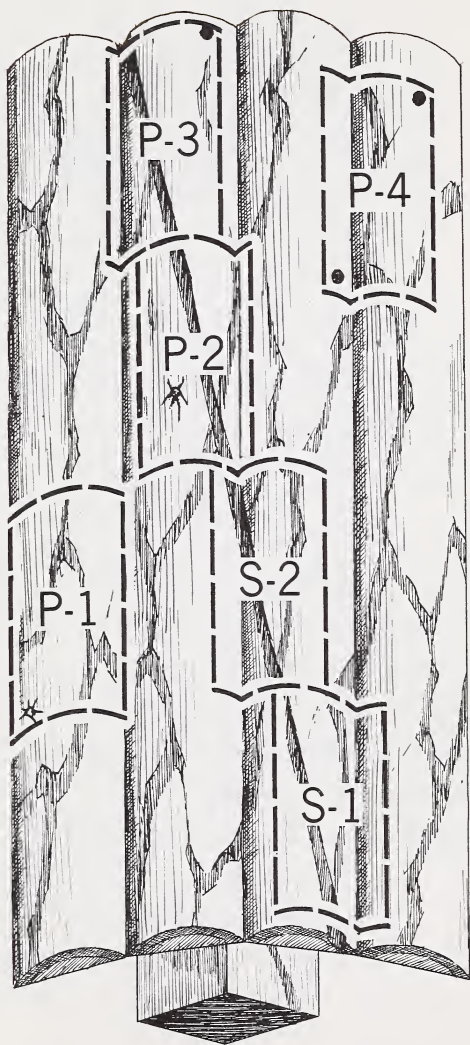


Figure 8

Figure 9 - Grade 3 Log

Specifications:

Primary and secondary defects are admitted without limit as to number or size, provided that at least six panels can be found that are free of all grading defects.

Explanation:

A minimum grade 3 log. Panels must be located individually and staggered in order to find six that are free of grading defects. The small scar near the top eliminates what would otherwise be a seventh defect-free panel.

Note that no panels overlap, and that there is no way that an additional defect-free panel can be located.

Most Likely Occurrence:

Middle logs of old-growth trees.

Lower logs of young-growth trees or rather open-grown old-growth trees.

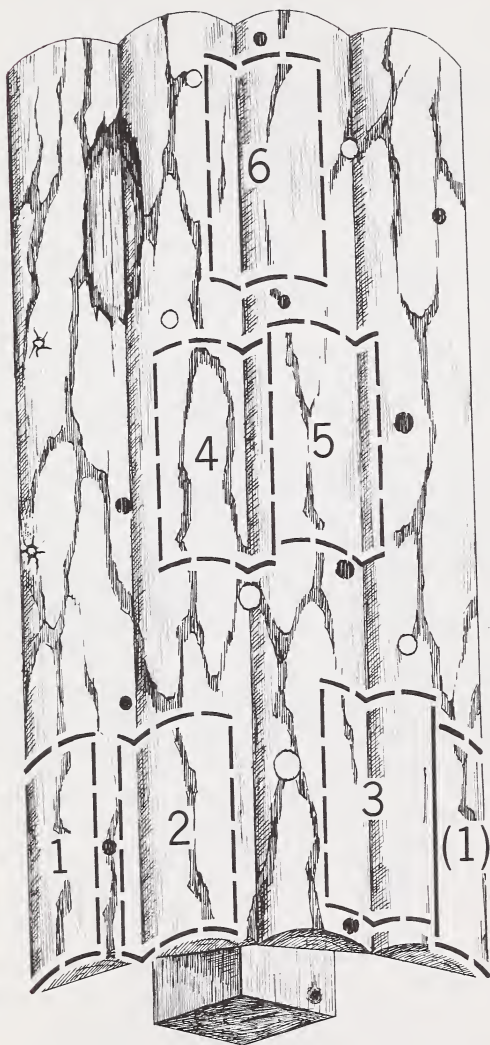


Figure 9

Figure 10 - Grade 3 Log

Specifications:

Primary and secondary defects are admitted without limit as to number or size, provided that at least six panels can be found that are free of all grading defects.

Explanation:

A fairly common type of "high-line" grade 3 log. The lower 8 feet is free of grading defect, to provide eight defect-free panels, plus a ninth in the upper half of the log.

Note however, that all defects can be contained within five panels, as shown by the light dashed lines. If the single live knot shown in panel P-2 were not present, the log would be grade 2.

The "no overlap" rule (item 10d, p. 3) applies only to panels of the same type: defect-free or defect-containing. One type or the other --never both-- finally determines the grade of the log. Hence, as in this case, defect-free panels may utilize some of the same surface area used if defect-containing panels are located.

Since full panels only (no fractions) are counted, the sum of defect-free and defect-containing panels may be less than 16, as in this case.

Similar situations will be found on trees with one-half the circumference (two faces) entirely free of defects.

Most Likely Occurrence:

Lower or middle logs of old-growth trees, depending on height and degree of competition.

Occasionally, butt logs of young-growth trees.

Figure 11 - Grade 3 Log

Specifications:

Primary and secondary defects are admitted without limit as to number or size, provided that at least six panels can be found that are free of all grading defects.

Explanation:

A common type of grade 3 log. When one log face (four vertically aligned panels) is free of defects, two additional defect-free panels can often be found.

Most Likely Occurrence:

Middle logs of old-growth trees.

Lower logs of trees in the edge of groups or on the edge of openings.

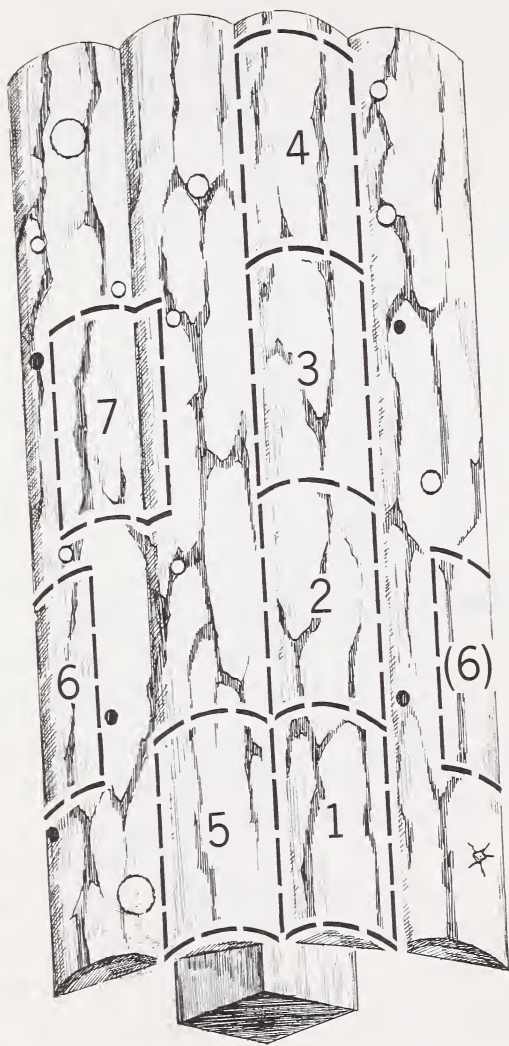


Figure 11

Figure 12 - Grade 3 Log

Specifications:

Primary and secondary defects are admitted without limit as to number or size, provided that at least six panels can be found that are free of all grading defects.

Explanation:

A common-type minimum grade 3 log. When the bottom 4 feet is free of grading defects (four defect-free panels), two additional defect-free panels can often be found.

Most Likely Occurrence:

Butt log of young-growth or open-grown old-growth trees.



Figure 12

Figure 13 - Grade 3 Log

Specifications:

Primary and secondary defects are admitted without limit as to number or size, provided that at least six panels can be found that are free of all grading defects.

Explanation:

A "high-line" grade 3 log. Even though there are 10 panels free of defect, 7 panels are required to enclose the defects--6 for the large fire scar and one for the knot at top of log. The knot must count as a defect, even though it falls in the trimming allowance.

If the scar were small enough to be contained in less than six panels, the log would be grade 2; if there were no scar, it would still be grade 2, as a knot in trim always counts the same as any place else on the log.

In tall trees, the log above this one may be grade 2. With only one knot on this log knots may be limited on the log above.

Note that defect-free plus defect-containing panels equal 17. See figure 1, page 6, of Technical Paper 75 (cited in Foreword) for another example of this apparent anomaly.

Most Likely Occurrence:

Butt log of old-growth trees.

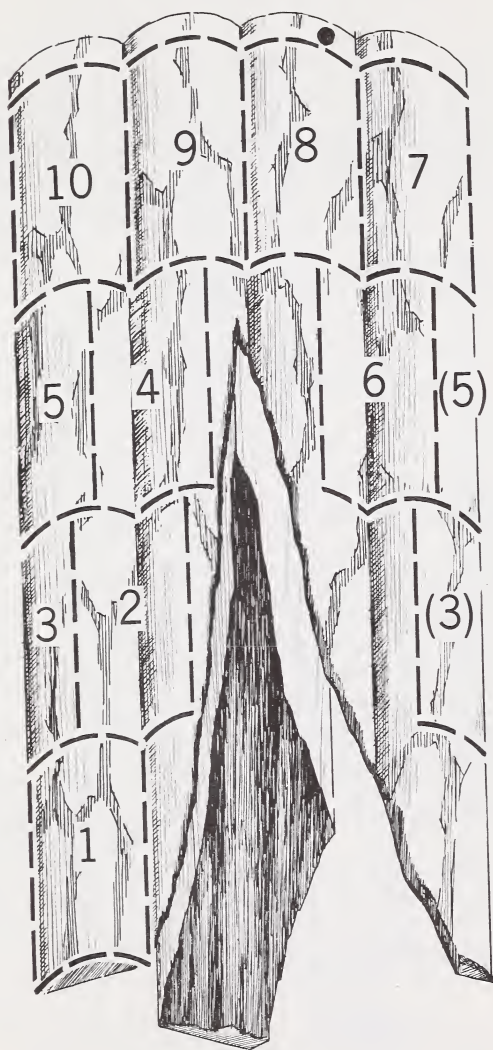


Figure 13

Figure 14 - Grade 4 Log

Specifications:

Primary defects are admitted with the following limitations:

1. At least 80 percent must be bark limbs.
A bark limb^{1/} is one to which the bark still adheres and is live or has been dead only a few years. It is expected to result in intergrown or tight, sound knots in lumber.
2. Size of defect is proportional to log diameter at the point of occurrence:
 - a. Of bark limb: Diameter inside bark at log surface must not exceed one-sixth of log diameter.
 - b. Of all other primary defects: Diameter at log surface must not exceed one-twelfth of log diameter.
3. Not more than 24 primary defects at or near (within one-half inch) maximum size are allowed.

Secondary defects are admitted in addition to primary defects, provided that they can be confined within three panels or less.

Explanation:

A typical grade 4 log; small limbs, 29 out of 35 (83 percent) with bark.

Most Likely Occurrence:

Middle and upper logs of young-growth trees, except those in open-grown stands; rarely the top log.

^{1/}An exception is the large, long-dead limb in the southwest and the Black Hills, where bark retention may be an indicator of red rot (Polyporus aniceps).

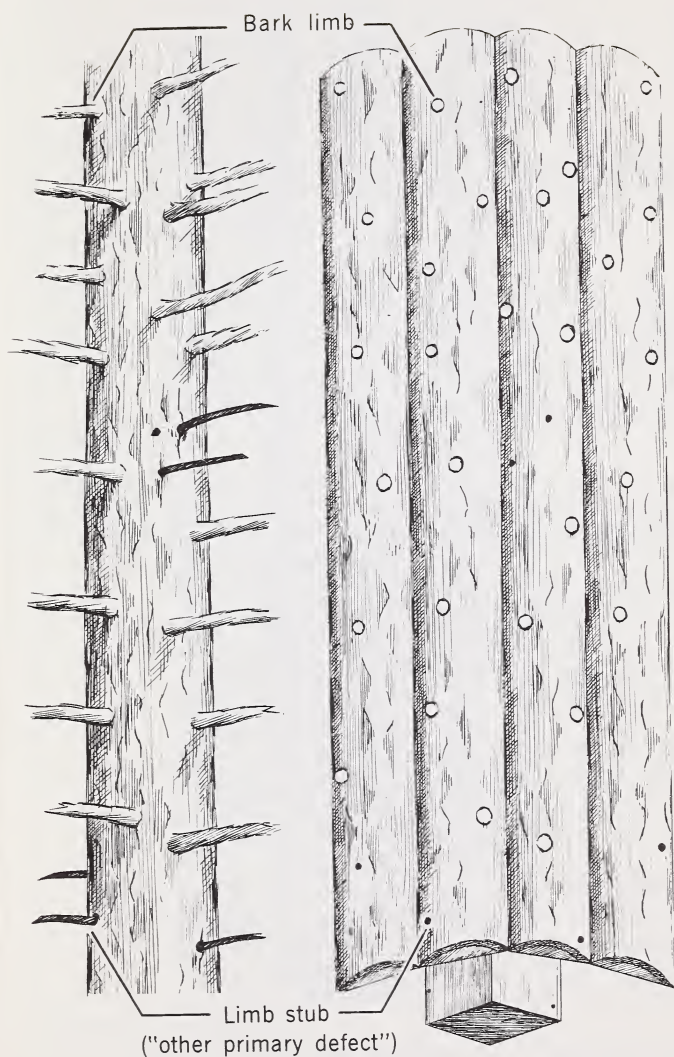


Figure 14

Figure 15 - Grade 4 Log

Specifications:

Primary defects are admitted with the following limitations:

1. At least 80 percent must be bark limbs. A bark limb^{2/} is one to which the bark still adheres and is live or has been dead only a few years. It is expected to result in intergrown or tight, sound knots in lumber.
2. Size of defect is proportional to log diameter at the point of occurrence:
 - a. Of bark limb: Diameter inside bark at log surface must not exceed one-sixth of log diameter.
 - b. Of all other primary defects: Diameter at log surface must not exceed one-twelfth of log diameter.
3. Not more than 24 primary defects at or near (within one-half inch) maximum size are allowed.

Secondary defects are admitted in addition to primary defects, provided that they can be confined within three panels or less.

Explanation:

A minimum grade 4 log. Knots are similar to figure 14 but a secondary defect (scar) requires three panels to enclose it. Secondary defects on grade 4 logs are evaluated without regard to surrounding primary defects. Compare with figure 20.

Most Likely Occurrence:

Middle and upper logs of young-growth trees, except those in open-grown stands; rarely the top log.

^{2/} See footnote on p. 33.

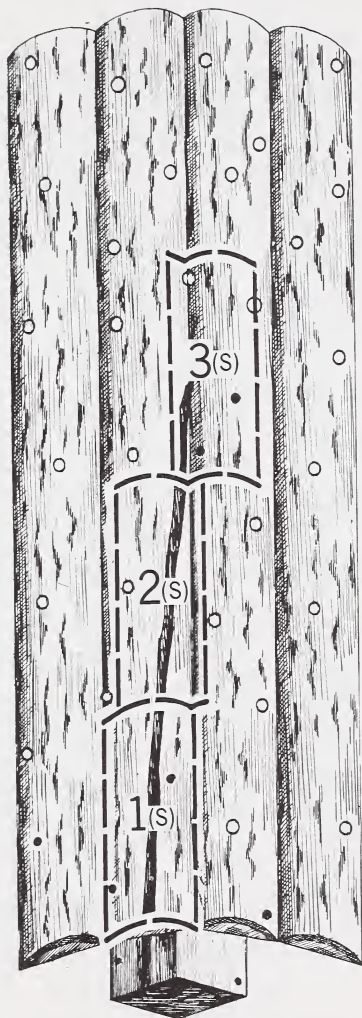


Figure 15

Figure 16 - Grade 5 Log

Specifications:

This grade includes all logs not qualifying for grades 1 through 4, but which are at least one-third sound by standard Forest Service scaling procedure.

Explanation:

A typical grade 5 log. Only three defect-free panels can be found. The log knots are all dead (bare of bark) limbs, limb stubs, or overgrown limbs.

Most Likely Occurrence:

Middle logs of many trees.

Lower logs of young-growth and open-grown old-growth trees.



Figure 16

Figure 17 - Grade 5 Log

Specifications:

This grade includes all logs not qualifying for grades 1 through 4, but which are at least one-third sound by standard Forest Service scaling procedure.

Explanation:

This is a common type of Grade 5 log.

Only three defect-free panels can be found. Log knots are too large to permit consideration as Grade 4, even though most of them are bark limbs.

Grade 5 logs often have even larger knots, fewer defect-free panels or a lower proportion of bark limbs than does this one.

Most Likely Occurrence:

Upper logs of old-growth trees.

Middle and upper logs of young-growth trees, especially if open-grown.

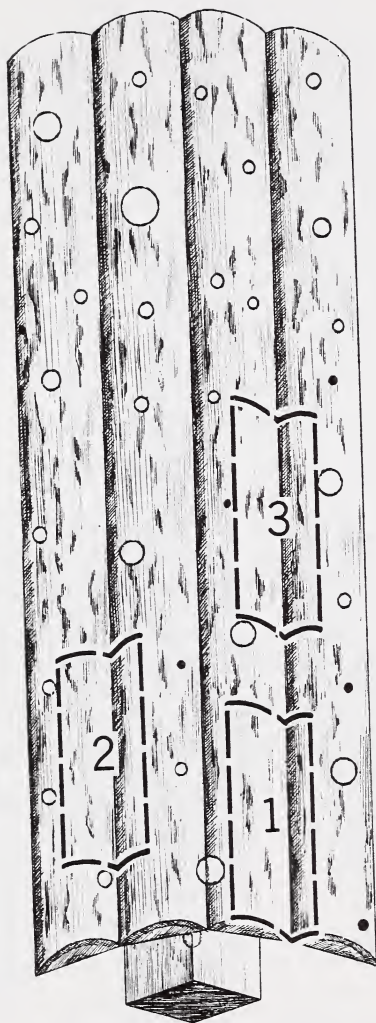


Figure 17

Figure 18 - Grade 5 Log

Specifications:

This grade includes all logs not qualifying for grades 1 through 4, but which are at least one-third sound by standard Forest Service scaling procedure.

Explanation:

Only five defect-free panels can be located on this log.

In tall trees, the log above this one may be grade 3, as the arrangement of log knots suggests that the next log may have sizeable areas free of grading defects.

Note: Examine any log with a fire scar like this very carefully, to be sure it is not a cull.

Most Likely Occurrence:

Butt log of old-growth trees.

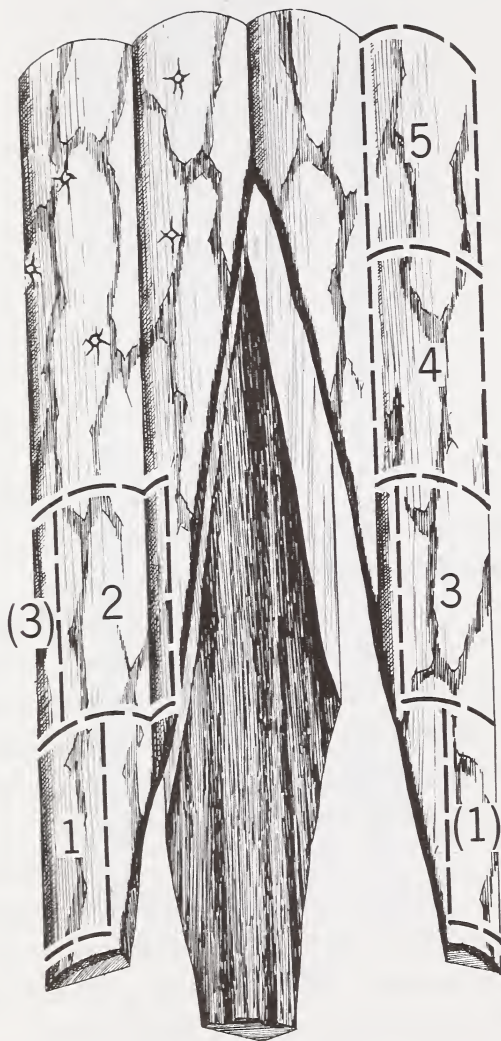


Figure 18

Figure 19 - Grade 5 Log

Specifications:

This grade includes all logs not qualifying for grades 1 through 4, but which are at least one-third sound by standard Forest Service scaling procedure.

Explanation:

This log does not quite qualify as grade 4. Only 30 out of 39 log knots (77 percent) are bark limbs. One live limb near the bottom is over-size--(diameter exceeds one-sixth of log diameter). Compare with figure 14.

Most Likely Occurrence:

Middle logs of young-growth trees.

Occasionally, upper logs of old-growth trees in dense stands.

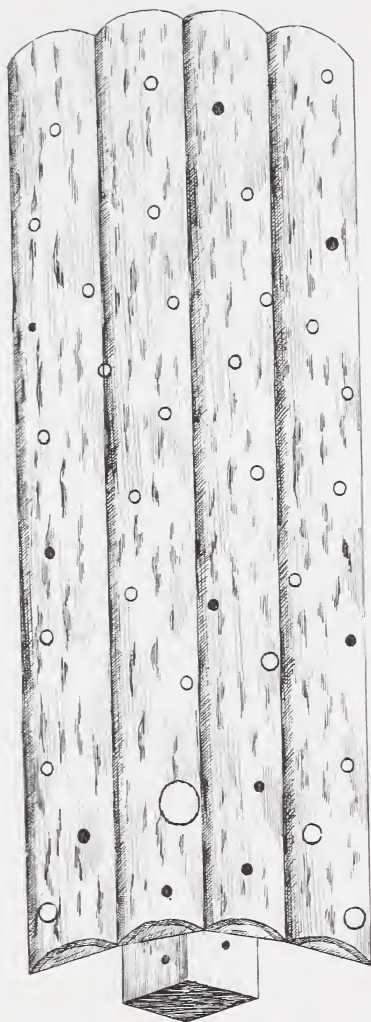


Figure 19

Figure 20 - Grade 5 Log

Specifications:

This grade includes all logs not qualifying for grades 1 through 4, but which are at least one-third sound by standard Forest Service scaling procedure.

Explanation:

This log would be grade 4, except that a lightning scar runs full length and hence cannot be confined to 3 panels. Compare with figure 15.

This type log is not common, even where lightning is frequent. Other types of secondary defects that might degrade such a log from grade 4 to grade 5, include scars from other causes (such as porcupine damage), cankers, and the distorted stem area associated with forks or crooks.

Most Likely Occurrence:

Upper logs of young-growth trees in dense stands.

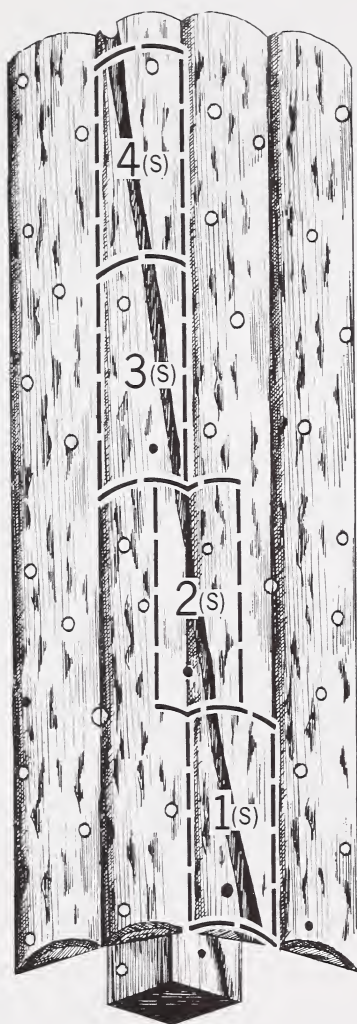


Figure 20

Suggestions for Field Grading

The beginning log grader, during training and initial on-the-job grading, will usually find it desirable to judge each log in the order of the grades from high to low. If it won't make grade 1, will it make grade 2? And so on.

Experienced graders commonly develop short-cuts and rules-of-thumb to speed up their work. Many have found the following procedure useful:

- A. Make a quick initial sizeup of the log. Decide what the alternative grades will probably be:
 1. Between grade 1 and grade 2, if initial sizeup reveals:
 - a. No log knots.
 - b. No extensive secondary defects.
 2. Between grade 2 and grade 3, if initial sizeup reveals:
 - a. Few log knots.
 - b. Two faces, or lower 8 feet, free of log knots.
 - c. When log knots present, no extensive secondary defects.
 - d. Large secondary defects, if no (or few) log knots.

3. Between grade 3 and grade 5 (or grade 3 and grade 4), if initial sizeup reveals:
 - a. Many log knots, but noticeable defect-free areas of panel size.
 - b. One face has three defect-free panels.
 - c. Lower 4 feet has three defect-free panels.
 4. Between grade 4 and grade 5, if initial sizeup reveals:
 - a. Many log knots, no defect-free areas of panel size, log knots small and are mostly live or bark-covered (recently dead) limbs.
 - b. No extensive secondary defect.
 5. Probably grade 5 (no alternative) if initial sizeup reveals many log knots and no defect-free areas of panel size, and if one or more log knots are quite large or many log knots are barkless limbs, limb stubs, or overgrown knots.
- B. Then examine the log carefully to decide the grade.
1. Grade 1 logs.
 - a. Be sure the log has no more than 1 pin knot. Watch especially for overgrown knots.

- b. Be sure all secondary defect can be confined within three panels.
 - c. Do not count area of butt scars below stump height.
 - d. Put edge of scars in panel corner to insure minimum panels for entire scar.
2. Grade 2 logs.
- a. Four log knots cannot require more than four panels.
 - b. Five log knots require only four panels if two can be put on one panel.
 - c. Six or more log knots may still require only four panels if they are well-grouped.
 - d. Put isolated log knot in corner of a panel, so panel will include as many other defects as possible.
 - e. Place edge of scar in corner of panel, as for grade 1 logs.
3. Grade 3 logs.
- a. Six panels must be free of secondary defect as well as log knots.
 - b. Look for defect-free panels on lower 4 feet and on one face: unless three

can be found in these areas, the chance of finding a total of six is rather low.

- c. Pick a distinguishable reference point (unusual limb, shadow-edge, etc.) as a starting point for working around the tree.

4. Grade 4 logs.

- a. Mostly middle and upper logs of young-growth or intermediate-aged trees; rarely in old trees.
- b. Check first for a definitely oversize log knot: one eliminates the log from grade 4.
- c. Count bark limbs and other log knots to be sure 80 percent or more are bark limbs.
- d. Secondary defects rarely limiting; but check to be sure they can be confined within three panels.

5. Grade 5 logs.

- a. Be sure no more than five defect-free panels can be found.
- b. Be sure one log knot is too large for grade 4, or there are too few bark limbs.

- c. If large scaling defects are present,
be sure log is one-third sound.

C. General considerations may help speed the job:

1. Upper logs in old-growth trees are almost always grade 5.
2. Most logs of open-grown trees may be grade 5.
3. In young-growth trees, (if not open-grown):
 - a. Lower logs are usually grade 5.
 - b. Butt log may be grade 3 (rarely grade 2) in trees in very dense stands.
 - c. Middle logs often grade 4 (in and just below the lower live crown).
 - d. Top log is usually grade 5.
4. In old-growth trees, a log seldom is a higher grade than the log just below it.
Watch for exceptions:
 - a. When butt log is degraded by large fire scar, second log may be higher grade.
 - b. Very occasionally in tall trees, a "low-line" grade 3 log (six defect-free panels) is found above a "high-line" grade 5 (five defect-free panels).

D. Always use the strict definitions of grades
and grading defects to reach final decision.





